IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application Of:	)	
	)	
Michael Chad HOLLIS, *et al.*	)	GROUP ART UNIT: 3724
	)	
APPLICATION NUMBER: 10/717,536	)	EXAMINER: Stephen CHOI
	)	
FILED: November 21, 2003	)	CONFIRMATION NO.: 7980

FOR: BEVEL ANGLE LOCKING ACTUATOR AND BEVEL ANGLE LOCKING SYSTEM FOR A SAW

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF PRIOR INVENTION UNDER 37 C.F.R § 1.131

Dear Sir:

WE, Michael Chad Hollis and Craig Allen Carroll, the applicants and co-inventors of the above-identified patent application declare as follows:

1. THAT we are co-inventors of the subject matter of all the pending claims (i.e., claims 1-5, 29-31, and 52-54) of the above-identified U.S. Patent Application. We have assigned all rights, title and interest in the above-identified invention to Delta International Machinery Corp. This declaration is submitted in furtherance of prosecution of the above-identified patent application.

2. THAT we filed a provisional application (the "provisional application") on November 26, 2002 describing the invention. The provisional application was assigned serial number 60/428,931. The above-identified application was then filed on November 21, 2003, claiming the benefit of the provisional application.

3. THAT prior to November 8, 2002 we had conceived and diligently worked to reduce to practice the invention described in the provisional application, as defined by claims 1-5, 29-31, and 52-54, and as evidenced by the attached solid model renderings (Exhibit A) annotated figures. The attached email dated October 30, 2002, the attached fax dated November 25, 2002, and the attached email dated November 26, 2002 (Exhibits B-D respectively) are further evidence that we were diligent prior to November 8, 2002 up to the point of constructive reduction to practice of the above-identified invention. The October 30 email (Exhibit B) shows that a draft of the provisional application was ready for our review on October 30, 2002. The November 25 fax (Exhibit C) is evidence of our corrections to that provisional application on that date, and the November 26 email (Exhibit D) is

further evidence of our diligence to file the provisional application in a timely manner.

4. THAT the conception and reduction to practice was performed entirely within the United States.

5. THAT all statements made herein of our knowledge are true, that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine, or imprisonment, or both under § 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

_____ Date:_____
Michael Chad Hollis

Craig A. Carroll Date: 3/29/06
Craig Allen Carroll

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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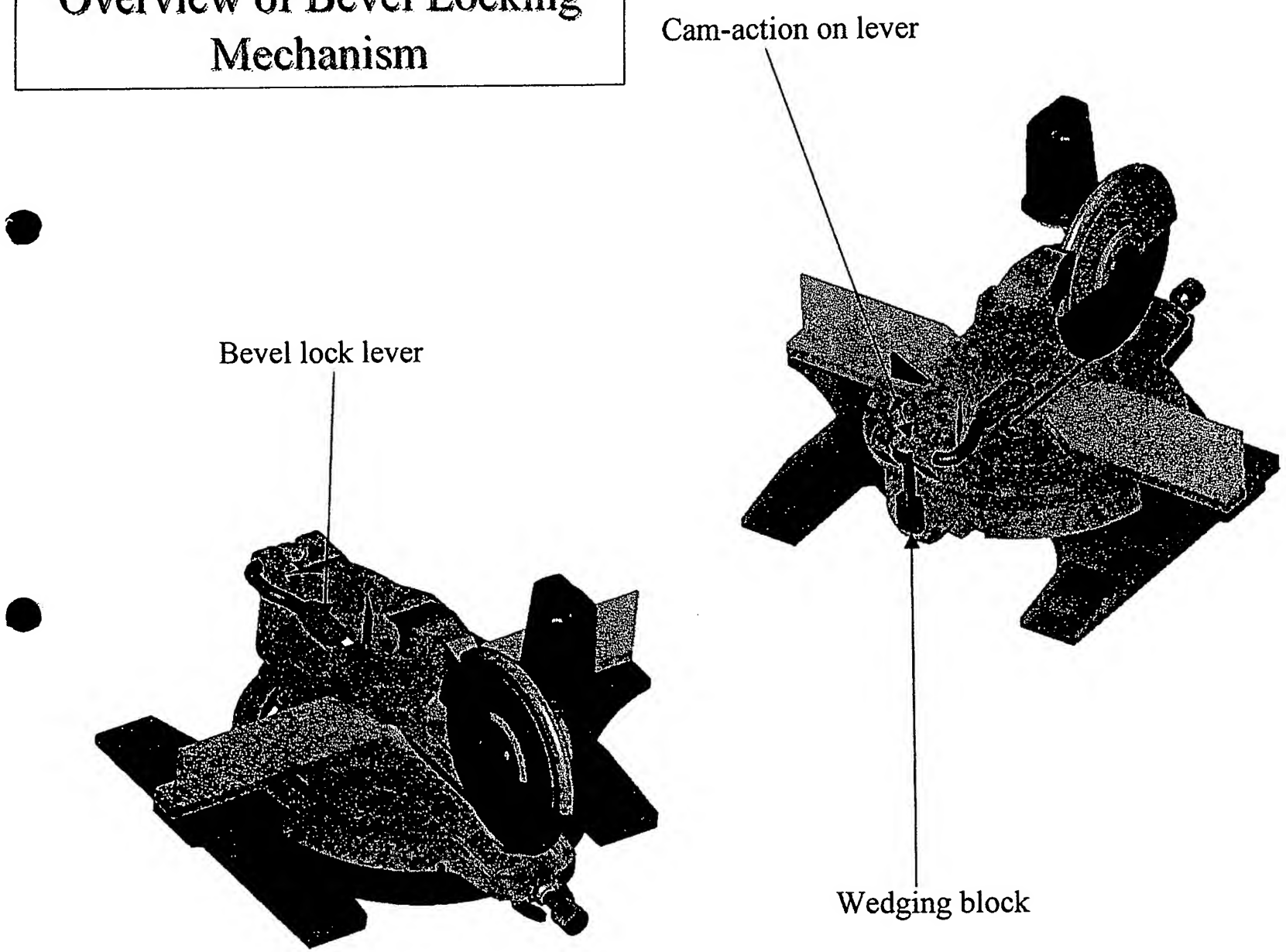
5. THAT all statements made herein of our knowledge are true, that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine, or imprisonment, or both under § 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

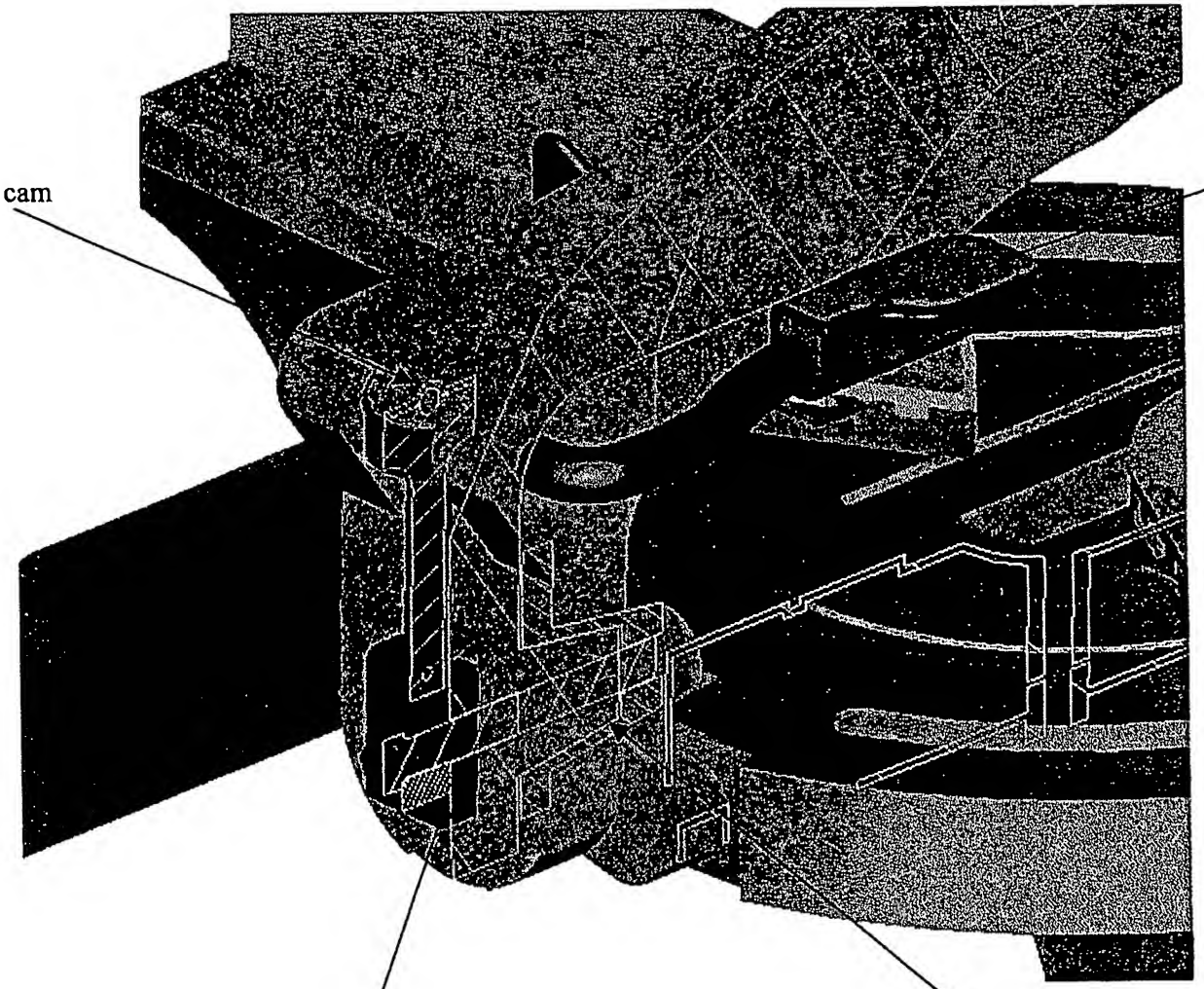
Michael Chad Hollis Date: 3-30-06

Craig Allen Carroll Date: _____

Overview of Bevel Locking Mechanism



Cross-section of Bevel Locking Mechanism



Eccentric cam

As lever is moved downward, eccentric cam forces linkage upward.

Casting is tapered parallel to taper on wedging block.

As linkage moves upward, male taper is forced into female taper.

Exhibit B

Ririe, Andrew

From: Ririe, Andrew
Sent: Wednesday, October 30, 2002 11:16 AM
To: Chad Hollis (E-mail)
Cc: Campbell, Chris
Subject: draft of provisional pat. app. for lever bevel lock

Chad,

I am attaching a working draft of the bevel lever lock provisional patent app. I welcome all comments from you. In one or two places I specifically ask for your comments and additional information about the design. Please note that I still have a few notes to myself in this draft regarding sections of the application that need further work.

I look forward to hearing back from you. As soon as we get this filed (hopefully in less than a week), I plan to start working with you on the provisional patent application for the sliding fence and clamp on the 3809.

Best regards,

--Andrew Ririe

Porter-Cable • Delta
4825 Highway 45, North
Jackson, TN 38305
(901) 668-8600

Exhibit C

PORTER-CABLE
Pentair Tool & Equipment Group
DELTA

FAX COVER SHEET

Date: 11/25/02

To: Andrew Rice — Fax: 202-778-2201

From: Chad Hollis — Fax: (731) 660-9381
Porter-Cable/Delta — Phone: (731) 660-9919

Subject: bevel lock provisional

No. of Pages (including this cover sheet) 17

Andrew,

Please find attached corrections to provisional application for bevel locking feature. All drawings are current, please let me know if you need any more.

Thanks,

Chad

HUNTON& WILLIAMS

PORTER CABLE DELTA
POWER TOOL PROFESSIONALS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION

Title of Application:	Bevel Locking Mechanism on a Miter Saw
Type of Application:	Provisional
Inventors:	~~Chad Michael Hollis~~ Michael Chad Hollis ~~Cunningham~~ Craig Allen Carroll
Attorney Contacts:	Chris Campbell (703) 714-7553, Andrew Ririe (202) 955-1672
H&W Matter No:	56709.000013
App. Serial No:	*Not yet assigned*
Filing Date:	*Not yet assigned*
Last Edit Date:	September 26, 2002
Instructions:	Please review this draft of the provisional patent application to be sure all of the relevant details of the inventive concepts have been fully stated and adequately explained.

PROPRIETARY AND CONFIDENTIAL, ATTORNEY-CLIENT PRIVILEGED
NOT FOR PUBLIC DISCLOSURE

Bevel Locking Mechanism on a Miter Saw

Background

Compound miter saws typically comprise a base assembly having a turntable rotatably mounted on a base to turn about a vertical axis, and a saw support assembly pivotally mounted to the turntable to turn about a horizontal axis coplanar with the top of the base assembly and normal to the axis of the turntable. Miter saws also typically comprise a saw unit pivotally mounted to the saw support assembly to plunge a saw blade into a work piece lying on the base. The base assembly also typically has a fence attached to the base for aligning a workpiece on the base assembly and holding it in position during a cut. The miter angle is the angle of cut adjusted by rotating the turntable and the saw blade about the vertical axis. The bevel angle is the angle of cut adjusted by rotating the saw support assembly and the saw blade about the horizontal axis. In a compound miter saw, the miter angle and the bevel angle can be adjusted independently of one another, or they can be adjusted simultaneously to make a compound angle cut with a miter angle component and a bevel angle component.

Other types of saws may also have the ability to adjust the bevel angle of cut. For example, a dry metal cutting saw such as [look for one off of the list] may include a saw support assembly mounted to a base (without a turntable), ~~what list~~ 1410?

where the saw support assembly pivots about a horizontal axis coplanar with the top of the base to adjust the bevel angle of cut.

This invention relates generally to saws where the bevel angle of cut can be adjusted.

In order to set-up for a cut including a bevel angle component, the bevel angle is first adjusted to the desired angle by rotating the saw support assembly and the saw unit about the horizontal axis. The saw support assembly must then be locked to hold to the desired bevel angle while the cut is being made. Prior art bevel angle locking mechanisms clamp together opposing surfaces of the saw support assembly and the base assembly to hold the bevel angle with friction. The bevel angle locking mechanism described in U.S. Patent No. 5,235,889 ("the '889 patent") is illustrative. Typically these bevel angle locking mechanisms have comprised a shaft or pin projecting from the base assembly out through the saw support assembly, such as shaft 81 in FIG. 7 of the '889 patent. A handle is threaded onto the end of the post or pin projecting from the saw support assembly, such handle 78 in combination with stop 81 in FIG. 7 of the '889 patent. When the nut is tightened, the saw support assembly is pushed against the base

assembly and friction prevents the saw support assembly from rotating relative to the base assembly.

The above-described type of bevel angle locking mechanism suffers from the drawback that it is sometimes awkward to reach around to the back of the saw to loosen and tighten the nut for locking the bevel angle.

mention Safety issue?

Brief Description of the Drawing Figures

FIG. 1 is an isometric view of an exemplary miter saw incorporating an exemplary embodiment of the bevel locking system of the present invention.

FIG. 2 is an isometric view of the bevel locking system of FIG. 1 in an unlocked position.

FIG. 3 is a detail, plan view of the bevel locking system in the same position as in FIG. 2.

FIG. 4 is an isometric view of the bevel locking system of FIG. 1 in a locked position.

FIG. 5 is a detail, plan view of the bevel locking system in the same position as in FIG. 4.

FIG. 6 is an exploded view of some of the components of the exemplary bevel locking system of the present invention.

Detailed Description of the Invention

An exemplary miter saw is shown in FIGS. 1-6. The inventions described herein can be used with any type of miter saw, it is not limited to use in the particular type of miter saw depicted in the figures. In addition, the inventions described herein may be useful for other types of saws which are capable of making bevel angle cuts, such as the dry metal saw already referred to above. The description herein of the invention as it can be used with a miter saw should be sufficient to show how the invention could also be applied to other types of saws.

An exemplary embodiment of the inventions is incorporated into the miter saw shown in FIGS. 1-6. It should be likewise understood that the inventions are capable of being practiced in other embodiments dissimilar in certain respects to the particular embodiment depicted in the figures. The scope of the invention is not intended to be limited by the depiction of the particular embodiment in the figures, nor the written description of that embodiment which follows.

An exemplary miter saw is shown in FIG. 1 comprising a base assembly 100 which can include a base 110 and a turntable 120. The turntable 120 is rotatably supported by the base 110 to turn about a vertical axis. A handle 121 can be grasped by the user to rotate the turntable 120 on the base 110 about a vertical axis to adjust the saw's miter angle. A miter lock is provided to lock the turntable 120 at a desired miter angle. The miter lock can be provided, as is known in the art, integral with the handle 121. By turning the handle 121, the turntable 120 can be clamped to the base 110 using screw threads formed on the handle. A detent system may also be provided, as is known in the art, for assisting the user in adjusting the turntable 120 to commonly used miter angles. The detent system may have an override actuator 122, commonly a lever, mounted in close proximity to the handle 121.

~ also using cam / linkage system.

The base assembly 100 may also include a fence assembly 130. The fence assembly 130 may be mounted to the base 110 and overlap a portion of the turntable 120, as shown in FIG. 1. A top surface 101 of the base assembly 100 and the front surface of the fence assembly 130 together support a workpiece during cutting.

A saw support assembly 200 is rotationally mounted to the turntable 120 to rotate about a horizontal axis. The saw support assembly 200 is rotationally

mounted so that its horizontal axis of rotation is approximately coplanar with the top surface 101 of the base assembly 100. The saw support assembly 200 rotates to adjust the bevel angle of the miter saw.

In this embodiment, the rotational connection of the saw support assembly 200 to the base assembly 100 is made at a knuckle 140. The knuckle 140 has a female conical surface 141 formed thereon. The saw support assembly 200 has a male conical surface 221 formed thereon. The female conical surface 141 and the male conical surface 221 are in contact with one another and support the saw support assembly 200 for rotational movement. The type of rotational mounting for a saw support assembly with a male and female conical surface, sometimes called a trunnion, is described in U.S. Patent No. 5,235,889. Of course, the location of the male and female conical surface could be reversed with the male conical surface being formed on the base assembly 100 and the female conical surface being formed on the saw support assembly 200. Other arrangements for rotationally mounting the saw support assembly 200 to the base assembly 100 which permit adjustment of the bevel angle are also possible and the principles of this invention may embrace miter saws with those other arrangements. For example, some miter saws, such as that illustrated in U.S. Patent No. 5,425,294 use flat surfaces on the base assembly and the saw support

assembly as well as a pin to rotationally support the saw support assembly on the base assembly (see FIG. 10 of the '294 patent).

A saw assembly 300 is pivotally mounted to the saw support assembly 200. In the illustrated embodiment, the saw assembly 300 may include an upper arm 310. The saw support assembly 200 may include a lower arm 210. The upper arm 310 and the lower arm 210 are pivotally connected with a pin 311. The saw assembly 300 mounts a saw unit 320 which has a motor driving a saw blade 321. The saw support assembly 200 pivots the saw assembly 300 about pin 311 to plunge the saw blade 321 into a workpiece lying on the top surface 101 of the base assembly 100. A handle 330 is connected to the saw assembly 300 and is graspable by the user to control the plunging of the saw blade 321 into the workpiece. The handle 330 includes a power switch 331 for actuating the motor of the saw unit 320.

The base assembly 100, or the saw support assembly 200, may also include a slide mechanism which permits the saw unit 320 to translate horizontally along an axis parallel with the top surface 101. In the illustrated embodiment, the slide mechanism 150 is part of the base assembly 100. The slide mechanism comprises two slide rods 151, 152. The slide rods 151, 152 are supported by and slide out from the turntable 120. The knuckle 140 is mounted to the slide rods 151, 152. A

slide mechanism may instead be part of a saw support assembly. In that case, a knuckle can be directly mounted to a turntable, or can be integrally formed with a turntable.

In the illustrated embodiment, the male conical surface 221 of the saw support assembly 200 is formed on a trunnion insert 220. The trunnion insert 220 is attached to the lower arm 210 during assembly of the miter saw with threaded fasteners (not shown). The trunnion insert 220 includes a cylindrical portion 222 on the end of which is formed the male conical surface 221. The cylindrical portion 222 engages a bore 211 formed through the lower arm 210 in such a manner that the male conical surface 221 extends out from the lower arm 210 towards the knuckle 140. One advantage of forming the male conical surface 221 on the trunnion insert 220 is simplified machining. The male conical surface 221 can be more easily machined on the relatively small trunnion insert 220 than on the lower arm 210. **[Chad, I am guessing this is the case, is this true? Comments?]** Another advantage is that the trunnion insert 220 can be formed from a different metal than the rest of the lower arm 210. For example, the lower arm 210 could be formed from cast aluminum, while the trunnion insert 220 can be formed from cast iron. Aluminum on aluminum wear surfaces can be problematic. If the knuckle 140 (including the female conical surface 141) is

Reasons for making male trunnion on separate piece:
taper
1.) Easier to machine
2.) Material needs to be dissimilar to Aluminum (cast iron/steel in this case due to galling effect - high friction coefficient.
3.) Tooling more expensive to add male taper to 210

formed from cast aluminum, it may be advantageous to form the male conical surface on a separate cast iron trunnion insert 220 rather than on the cast aluminum lower arm 210 to avoid aluminum on aluminum wear surfaces (and still manufacture the lower arm from cast aluminum to minimize weight). Of course, the male conical surface could be directly formed on the lower arm 210.

The male conical surface 221 and the female conical surface 141 are compressed together in order to lock the position of the saw support assembly 200 relative to the base assembly 100 and lock the bevel angle. This is done by sliding a bevel locking linkage 230 to wedge the bevel locking linkage between two surfaces causing the male conical surface 221 and the female conical surface 141 to be pushed together. In this exemplary embodiment, sliding the bevel locking linkage 230 causes it to be wedged between cam surfaces 223 formed on the trunnion insert 220, and a bevel locking flange 230. The bevel locking flange 230 abuts a nut 240 threaded onto a shaft 250. Shaft 250 passes through the knuckle 140 and through the lower arm 210 and the trunnion insert 220.

In another embodiment (not shown), the bevel locking linkage could be wedged around a second shaft, parallel to the shaft 250 but spaced laterally therefrom. U.S. Patent No. 5,425,294 shows a miter saw design with two shafts, a

first shaft 4 and a second shaft connected to handle 5. In the '294 patent, handle 5 is rotated to push the saw support assembly against the base assembly. Instead, a bevel locking linkage could be associated with the second shaft so that when the linkage slides and is wedged, the second shaft will be tensioned and the bevel angle will be locked. **[Note: need to clean this up]**

NOTE: THIS IS MORE LIKE A CRANKSHAFT (MAYBE WORD IT SO EITHER CAN BE USED)

The bevel locking linkage 230 is caused to slide by a camming mechanism comprising a bevel lever 260 and a cam shaft 270. Cam shaft 270 is rotationally supported by the saw support assembly 200 and includes an eccentric shaft portion 271. The eccentric shaft portion 271 is linked to the bevel locking linkage 230. The bevel locking linkage 230 has a curved portion 231 on the end thereof which creates a pocket into which the eccentric shaft portion 271 fits. The eccentric shaft portion 271 is retained in the pocket by a block 232 which is attached to the bevel locking linkage 230 with a fastener (not shown). — Does this need to be shown?

One end of cam shaft 270 is fixed to the bevel locking lever 260. As the user moves the bevel locking lever 260, the cam shaft 270 rotates and the bevel locking linkage 230 is caused to slide up and down. FIG. 2 shows the bevel locking lever 260 in the unlocked or up position where the bevel locking linkage is pushed downward and the bevel angle is unlocked. FIG. 3 is a detail view

[Chad, what does the spring do that is between the trunnion insert and the locking flange.] — The spring provides a small amount of force to the male taper so that when unlocked the cutterhead will not disengage too far and cause the head to sag excessively.

FIG. 4 shows the bevel locking lever 260 in the locked or down position where the bevel locking linkage is pulled upward and the bevel angle is locked. FIG. 5 is a detail view of the bevel locking lever 260 in the down position. In the down position, the bevel locking lever can conform to the profile of the lower arm 210 or other part of the saw support assembly 200 to be as unobtrusive as possible. The bevel locking lever can be inexpensively produced as a stamped metal part, with a handle injection molded on the end thereof.

This bevel locking system has several advantages over the prior art. First, the user no longer needs to reach around to the back of the miter saw to turn a bevel locking nut. The user has easy access to the bevel locking lever 260 which is mounted much closer to the front of the saw. Second, the bevel locking lever 260 provides a convenient signal to the user when the bevel angle is not locked. Third, [Chad, can you comment on the advantages of the locking lever?]

Actuating a long lever arm is ergonomically more user friendly than rotating a knob to achieve locking force.

We Claim:

A1. A compound miter saw comprising:

a base assembly;

a saw unit having a saw blade turning about a first rotational axis to cut a workpiece;

a saw support assembly rotatably mounted to the base assembly, the saw support assembly rotating relative to the base assembly about a second rotational axis to adjust the bevel angle of the saw blade, and the saw support assembly supporting the saw unit and pivoting the saw unit to plunge the saw blade into a workpiece laying on the base assembly;

a bevel locking lever pivotally mounted to the saw support assembly, the bevel locking lever pivoting relative to the saw support assembly about a second rotational axis to actuate a bevel angle locking mechanism.

[B claims: Method of locking the bevel angle involving rotating a lever about an axis that is not the beveling axis. Deps include that the axis is orthogonal

and offset from the bevel axis, that in the locked position the lever is next to the saw support assembly's arm]

[C claims: Miter saw with bevel locking cam which translates in a direction orthogonal to the beveling axis to lock the beveling angle.]

C1. A miter saw comprising:

a base assembly;

a saw unit having a saw blade;

a saw support assembly rotatably mounted to the base assembly, the saw support assembly supporting the saw unit and pivoting the saw unit to plunge the saw blade into a workpiece lying on the base assembly, the saw support assembly rotating relative to the base assembly about a first rotational axis to adjust the bevel angle of the saw blade;

a bevel locking linkage which translates in a direction normal to the first rotational axis, the translation of the bevel locking linkage causing the saw support assembly to be pushed against the base assembly creating friction which prevents relative rotation.

something where there is a nut which is threaded to the post, but the part that moves to create the compressive pressure is not connected to the nut, or doesn't turn with the nut.

[D claims: Method claim like C claims] – Move detail?

[E claims: Miter saw with a separate, detachable trunnion piece that mounts to the saw support assembly, where the trunnion piece and the saw support assembly are made of different materials]

E1. A miter saw comprising:

a base assembly;

a saw unit having a saw blade turning to cut a workpiece;

a saw support assembly rotatably mounted to the base assembly, the saw support assembly rotating relative to the base assembly about a horizontal axis to adjust the bevel angle of the saw blade, and the saw support assembly supporting the saw unit and pivoting the saw unit to plunge the saw blade into a workpiece lying on the base assembly;

wherein the saw support assembly comprises a lower arm and a trunnion insert attached to the lower arm, the trunnion insert being made of a different metal than the lower arm.

- Milwaukee may have prior art in regard to claim 6.

Bevel Locking Mechanism on a Miter Saw

Abstract

A miter saw has a bevel locking lever for locking the bevel angle of the miter saw which is easier for the user to reach than prior art bevel angle locking mechanisms that are located at the rear of the miter saw. Also, a male conical surface for forming a trunnion for rotationally supporting the saw support assembly is formed on a trunnion insert which is mounted to the lower arm.

Exhibit D

Ririe, Andrew

From: Ririe, Andrew
Sent: Tuesday, November 26, 2002 2:24 PM
To: Chad Hollis (E-mail); Craig Carroll (E-mail)
Subject: Provisional patent app. for the bevel locking lever on the 3809

Chad and Craig,

Thank you for reviewing the draft of the provisional patent application for the bevel locking lever on the 3809 miter saw. Your corrections and comments were very helpful. I incorporated each of your corrections into the copy of the application that is attached.

I am going to file the provisional application today. The provisional does not need to be in perfect form. The provisional must disclose the invention in enough detail so that another person of skill in this art would understand how to make and use the invention. I think we have achieved that. Please let me know if you see any other corrections that should be made, or any further details that should be included, before I file the provisional tonight.

Once the provisional is filed, it is my understanding that Delta will revisit the application in a few months and decide whether a regular application which can mature into a patent is merited.

Best regards,

--Andrew

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